

APPENDIX E

CONFINED SPACE ENTRY

- E-1. General. These procedures establish minimum requirements for safe entry into, work in, and exit from confined spaces like tanks, vessels, manholes, pipelines, water transmission lines, tunnels, stilling wells, junction structures, valve and metering vaults, dry wells, and wet wells. These confined spaces are dangerous because gases and vapors accumulate to form oxygen deficient, toxic, or explosive atmospheres.
- E-2. Confined Space Entry Program. No one will enter a confined space unless these procedures (or equivalent procedures established by the subcontractor or client) are followed. The SSHO will determine whether alternate procedures are equivalent. A confined space entry program must include at a minimum:
- a. Responsibilities and duties of personnel associated with confined space entry activities.
 - b. Continuing evaluation and identification (posting) of confined spaces.
 - c. Coordination of confined space entry activities.
 - d. Specific training for confined space entrants.
 - e. Pre-entry review and permit preparation.
 - f. Provision of appropriate safety equipment.
 - g. Adherence to the buddy system.
 - h. Detection of hazardous conditions.
 - i. Ventilation of hazardous gases.
 - j. Written rescue and emergency services and procedures.
 - k. Vessel preparation, isolation, lockout/tagout.
 - l. Atmospheric testing, oxygen, toxicity, and flammability.

- m. Communication devices, hand, radio, rope.

E-3. Confined Space Entry Personnel. The roles of confined space entry personnel include:

- Confined Space Entry Coordinator. Personnel at the project trained and authorized in writing by the designated authorities to sign, issue, and revoke entry permits.
 - Person-in-Charge. An entry team member trained and authorized to certify that entry permit conditions have been met.
 - Confined Space Entrants. Entry team member trained to perform actual work in the confined space.
 - Entry Attendant. An individual stationed outside and required to remain outside the confined space while entrants are in the confined space, who monitors the authorized entrants and the confined space activities and, under specified conditions, authorizes evacuation of the confined space.
 - Rescue Personnel. Personnel who are trained, qualified, and authorized to respond to emergencies in confined spaces.
- a. The personnel who fill these roles must have completed training in these procedures and in site-specific confined space hazards identified by the SSHO.
 - b. Entry by personnel into any confined space where liquids or gases may have been present, or may occur during the entry, requires at least three persons: one entrant, one attendant, and one rescue worker. The attendant and rescue worker are to remain outside confined space. Rescue workers may perform other tasks during an entry if those tasks will not impede response to an emergency.
 - c. Personnel may fill the roles listed above only if they are qualified. All entrants and rescue teams must be trained in their entry-procedure responsibilities. A written record of the length and content of such training must be kept.

E-4. Confined Space Entry Permits.

- a. Written entry permits are required for any entry into, or work in, confined spaces. When a work team plans to enter a confined space, it must complete an entry permit form that contains, at a minimum, the information in Table E-1. Users are directed to create local forms meeting their specific needs. Forms should include the personnel, task, measurements, equipment required, and the emergency contact.
- b. Entry permits may be issued only by the Confined Space Entry Coordinator. Actual entry is authorized when the "Person in Charge" completes the pre-entry checklist on the entry permit and signs the form.
- c. Entry permits will address a single work project in a single confined space, for one work period, not to exceed 8 hours. The coordinator may issue permits for a task involving a group of spaces with a common hazard potential. A permit may allow work over a longer period, if the personnel, the tasks, and the hazards do not change.

E-5. Equipment Required for Confined Space Entry.

- a. USACE personnel may enter a confined space only with the equipment specified in the entry permit. The safety equipment listed below would be adequate for most foreseeable conditions.
- b. Personal Protective Equipment (PPE)
 - (1) Airline respirator or Self-Contained Breathing Apparatus (SCBA)
 - (2) Steel-toe safety shoes
 - (3) Hard hat
 - (4) Surgical PVC inner gloves
 - (5) Neoprene rubber outer gloves

TABLE E-1 CONFINED SPACE ENTRY PERMIT MINIMUM REQUIREMENTS

Space to be Entered: _____
 Nature of Task: _____
 Duration of Permit: From: _____ To: _____
 Person In Charge: _____
 Authorized Entrants: _____

 Attendant: _____
 Coordinator Signature: _____

Pre-Entry Check List

Needed? In Place? (To Be Initialed By Person in Charge)

_____	_____	Traffic cones or barriers in place
_____	_____	Safety harness with retrieval tripod in place
_____	_____	SCBA ready for emergency use
_____	_____	Valves tagged out (mark N/A if not applicable)
_____	_____	Electrical equipment disconnected & locked out (or N/A)
_____	_____	Protective clothing & equipment donned appropriately
_____	_____	Rescue worker is within easy reach

Personal Protective Equipment

Needed? In Place?		Needed? In Place?	
_____	_____	_____	_____
_____	Airline breathing mask	_____	SCBA
_____	Steel-toe safety shoes	_____	Hard hat
_____	Surgical PVC inner gloves	_____	Rubber outer gloves
_____	Chemical safety goggles	_____	Rubber overboots
_____	PVC rain suit	_____	Duct tape on seams
_____	Forced ventilation blower	_____	5-minute escape packs

Atmospheric Testing

Needed? In Place?

_____	_____	Oxygen deficiency (> 19.5% and < 21.5%)
_____	_____	Flammable gases (< 10% LEL)
_____	_____	Toxic gases (< PELs). (Specify: _____)
_____	_____	Ventilation blower pushing clean air into space
_____	_____	Gas Detector(s) - on the belts or suits of entrants
_____	_____	Atmospheric Testing - after period of ventilation

ENTRY APPROVED: _____
Person-in-Charge
Date

- (6) Chemical safety goggles
- (7) Rubber overboots or hip waders
- (8) PVC rain suit
- (9) Duct tape on the seams
- (10) Forced ventilation blower
- (11) Five-minute escape packs
- c. Rescue Equipment
 - (1) Parachute-type safety harness
 - (2) Safety lifeline
 - (3) Automatic rescue winch
 - (4) Rescue & retrieval tripod or derrick
 - (5) Two-way radios
 - (6) First-aid kit
- d. Routine confined space entries can be performed in regular work clothes if the entry team has enough information about the atmosphere inside the space. Some circumstances that would change the type of equipment needed include the following:

Respiratory protection is not necessary if:

 - (1) The monitoring equipment reveals no contaminants in the air and
 - (2) There is no potential source of contaminants and
 - (3) The oxygen level is at least 19.5 percent.
- e. If the air and surfaces in the space are free of contaminants, protective clothing is not needed.
- f. If air contaminants in the space can affect the worker by absorption through the skin, a Level A suit is required.
- g. A SCBA, in working order, must be ready for use.

- h. Only intrinsically-safe equipment may be used in confined spaces. Temporary lighting, whether electrically or battery operated, must be low-voltage, double-insulated, and explosion-proof. Tools used in confined spaces must be of a non-sparking type, unless there is no potential for flammable vapors or gases in the space.

E-6. Preparation for Entry.

- a. Inspect the area near the space for tripping hazards, traffic, and ignition sources, like lighted cigarettes. Remove them, if you can. Provide controls if you cannot move them.
- b. Inspect the condition of the entry steps of the confined space. Do not rely on a permanent ladder if the space is often wet. If it appears that the steps will not support your weight or if the confined space contains no steps, then provide a ladder and approved hoist or another form of ready entry and exit. Only one person at a time should ascend or descend a ladder. Personnel must not carry tools or other objects in their hands while climbing in or out of the confined space.
- c. If materials can flow into the space:
 - (1) And valves are motor operated: disconnect them, engage the lockouts, and attach a lockout tag.
 - (2) And valves are manually operated: either station someone at the valve handle or chain and padlock the handle.
 - (3) Install steel blanks in lines with flanged connections.
- d. The potential types of emergency in the spaces vary with the type of confined space. The rescue equipment, including the SCBA, should be inspected and tested prior to space entry.
- e. Coworkers must inspect each other's safety equipment before entry to determine if it is properly adjusted and in the proper position.

E-7. Monitoring.

- a. Combination combustible gas and oxygen indicators must be used to test the atmosphere of the confined space for the presence of combustible gases and adequate oxygen levels before entering. The permit must specify tests for any other dangerous contaminants, such as hydrogen sulfide, which could be present in the space.
- b. Prior to entry, the Person-in-Charge must test the atmosphere within the confined space with the meters as specified below.

- (1) Start up, check voltage, and field check the meters. Do not calibrate the detector with the probe in the confined space.
 - (2) Insert the probe about 12 inches into the space. Read the meters.
 - (3) Drop the probe to the level that workers in the space will occupy. Read it again.
 - (4) Measure for vapor conditions on the assumption that stratification of vapors has occurred in the tank. At a minimum, measure the top, middle, and bottom of the space as well as any identifiable pockets, corners, etc.
- c. Gases and vapors tend to stratify in confined spaces. One entrant must wear or carry the meter throughout the duration of the entry.
- d. If a toxic material is present above its exposure limit, or flammable gas is above 10 percent of the LEL, or oxygen is below 19.5 percent or above 21.5 percent, the team shall provide forced ventilation to eliminate these conditions and shall not make entry until these conditions are eliminated. The LEL must be less than 10 percent and oxygen levels must be between 19.5 percent and 22 percent.
- e. The air monitors must be field tested in accordance with the instructions contained in the instrument manual. If the detector fails the prescribed field tests, it must be recalibrated by the procedures established by the manufacturer. No entry is permitted unless the required measurements have been collected.

E-8. Ventilation.

- a. When monitoring indicates a need for ventilation, it must be provided until the monitor indicates acceptable air levels. Blowers should be coupled with a large-diameter, flexible hose that can direct air into the work area. Blowers used within confined spaces will be intrinsically safe. Gasoline, diesel, or gas-operated equipment used near confined spaces must be oriented so that their exhaust cannot enter the space.
- b. Continuous ventilation is desirable for any confined space entry. It is required for entry into any space where liquids or gases may have been present or could enter during the personnel entry.

E-9. Responsibilities During Confined Space Entry.

- a. The Person-in-Charge of the entry must:

- (1) Assure that the pre-entry checklist on the permit is completed before any employee enters a confined space.
 - (2) Evaluate the pre-entry conditions.
 - (3) Verify that the rescue worker is available and that the means for summoning is operable.
 - (4) Terminate the entry upon becoming aware of a nonpermitted condition.
- b. The Person-in-Charge of entry may serve as an entrant or an attendant in accordance with the sections below.
- c. The Entry Attendant must:
- (1) Remain outside the confined space.
 - (2) Leave only when replaced by an equally qualified individual or to save his/her own life. If the attendant must leave and there is no replacement, order the entrants to exit the confined space.
 - (3) Stay continuously aware of the location and condition of all authorized entrants within the confined space by voice, radio, telephone, visual observation, or other equally effective means.
 - (4) Stay continuously aware of conditions in the space.
 - (5) Order entrants to exit the confined space at the first indication of hazardous condition (such as instrument alarms, visible releases, or unusual behavior by the entrants).
 - (6) Summon immediate emergency assistance, if needed.
 - (7) Warn unauthorized persons not to enter or to exit immediately if they have entered. Advise the authorized entrants and management of entry by unauthorized persons.
 - (8) Assemble and inspect the equipment that the rescue worker would need to enter the space.
 - (9) Keep objects away from the access hole where they can be accidentally knocked, pushed, or dragged into the confined space. Lower tools or supplies to workers inside by a hand line.

- (10) If safety harnesses are worn into the space, secure the safety line to a nearby well-anchored object, never to movable equipment or a vehicle. Monitor the safety line at all times, taking up extra slack as needed. Keep the safety line away from traffic and equipment with moving parts.

d. Confined space entrants must:

- (1) Remove all jewelry before entering the space.
- (2) Inspect their own and each other's personal safety gear before entering the confined space.
- (3) Comply with these procedures and the conditions of the permit.
- (4) Follow the directions of the Person-in-Charge and the Attendant.
- (5) Leave the space and report to the Attendant immediately upon feeling the effects of a chemical exposure.
- (6) While working, avoid looking up.

E-10. Rescue Procedures.

a. Upon detecting an emergency condition, the personnel in the confined space must:

- (1) Move an incapacitated coworker in close proximity toward the exit. However, do not move towards the hazard, even to save a coworker.
- (2) Exit the space.
- (3) Immediately inform the Attendant of the nature of the hazard.

b. Upon detecting an emergency, the Attendant must:

- (1) Remain outside the confined space to lower necessary rescue equipment into the space and render other necessary assistance.
- (2) Start to withdraw the worker(s) with the safety line.
- (3) Notify the rescue worker(s).

- (4) Send someone to notify the emergency service providers specified in the permit. Give the location and any other pertinent information.
 - (5) Remain available to lower necessary rescue equipment into the space, render any other necessary assistance, and guide emergency units to the scene.
- c. Upon detecting an emergency, rescue workers must:
 - (1) Report to the confined space as quickly as possible.
 - (2) If appropriate, don a SCBA.
 - (3) Enter to offer assistance and correct the problem.
- d. Protection of employee life and health is the first priority of the rescue worker. No employee may enter the confined space without a SCBA until all causes of the incapacitation have been eliminated.
- e. The rescue team must be trained in:
 - (1) The requirements for entrants.
 - (2) The rescue functions assigned to them using the retrieval and rescue equipment furnished.
 - (3) Basic first aid and cardiopulmonary resuscitation.